

WWLLN: World Wide Lightning Location Network

- Global, ground-based network
- Currently 70+ sensors worldwide
- Established in early 2000s

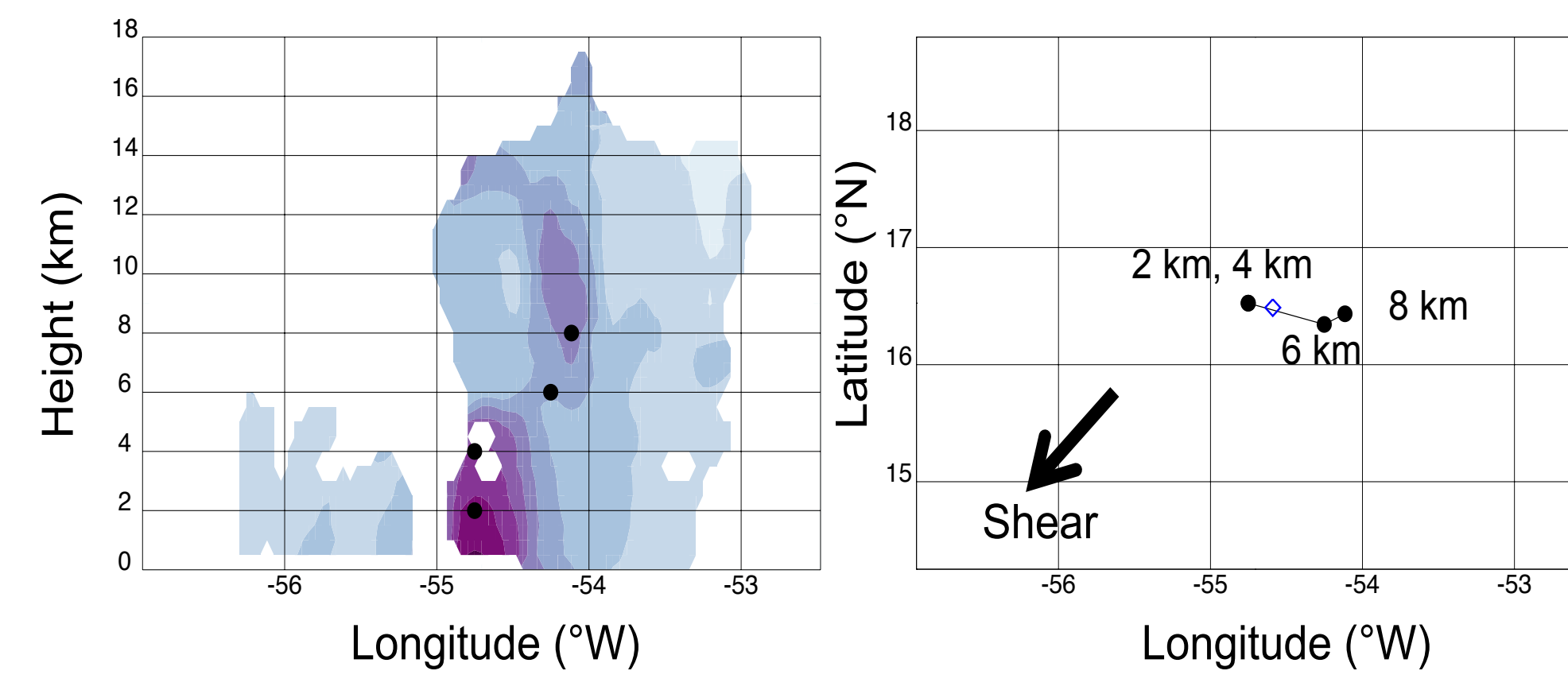
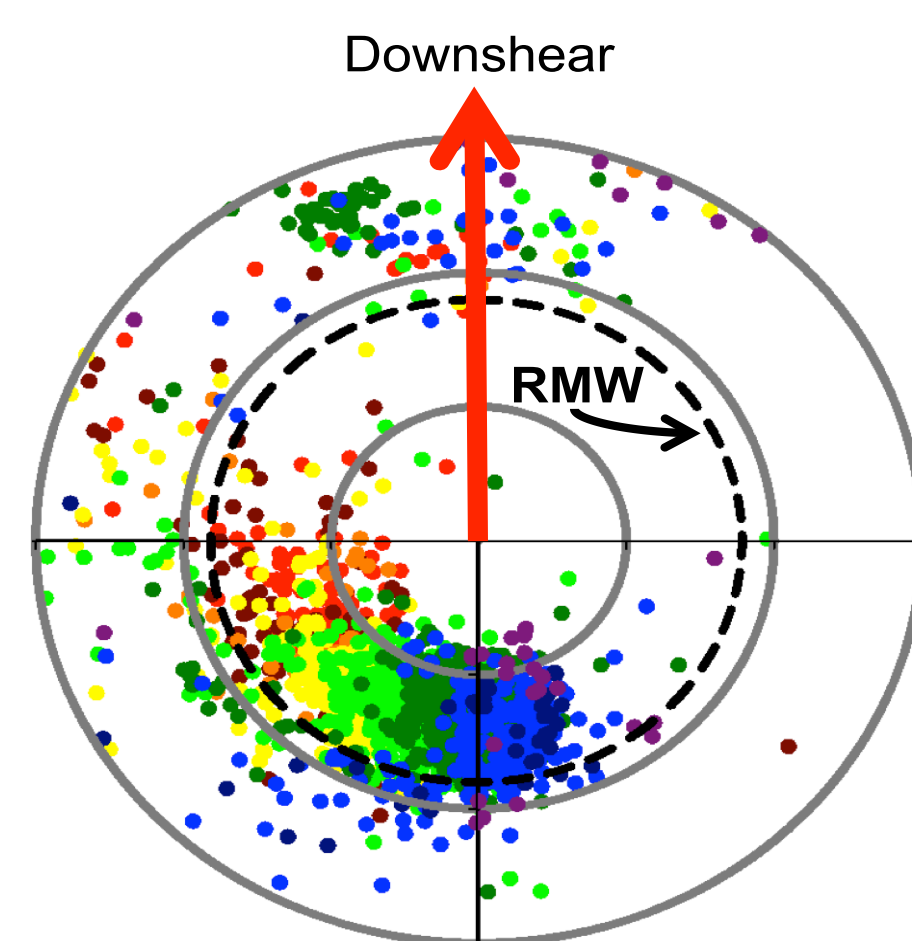
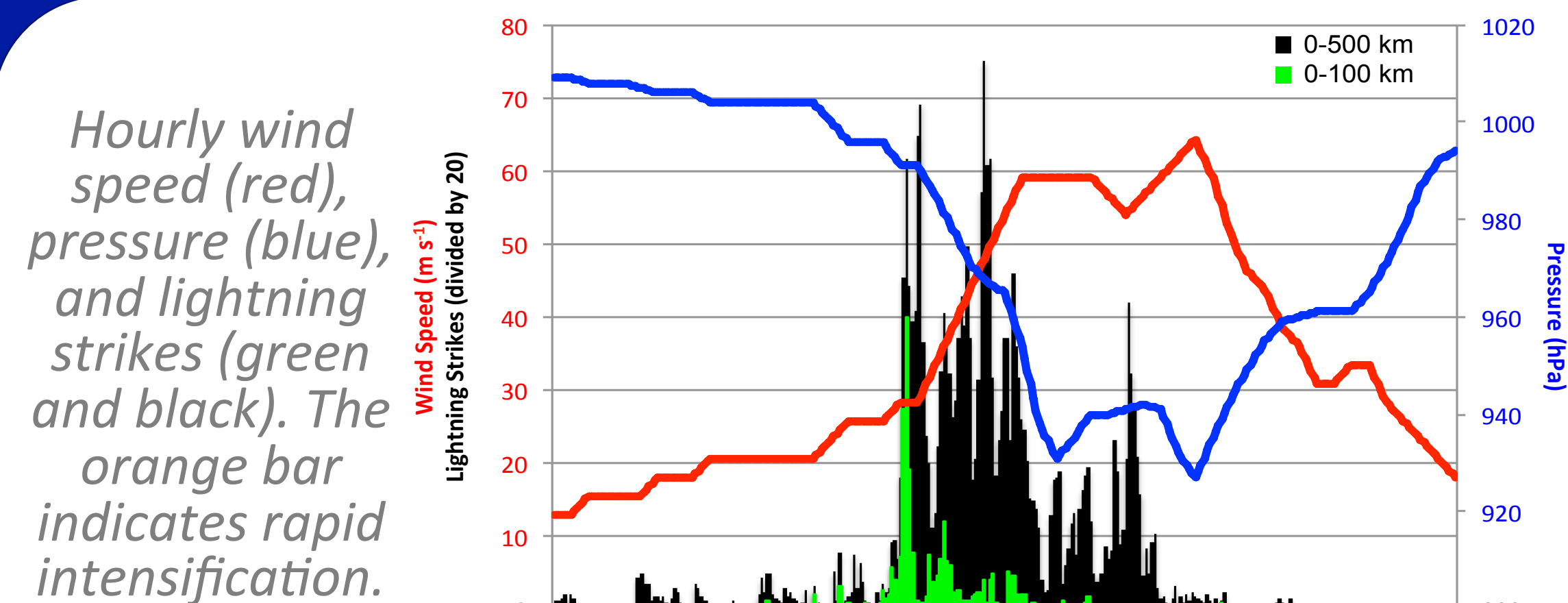
GRIP: Genesis and Rapid Intensification Processes

- Field campaign in **2010** aimed at understanding how tropical cyclones form and develop into major hurricanes
- Surveyed **four** Atlantic TCs using the DC8, the WB57, and Global Hawk

HS3: Hurricane and Severe Storm Sentinel

- Field campaign from **2012–2014** aimed at investigating hurricane formation and intensity change
- Surveyed **eight** Atlantic TCs using two Global Hawks and the WB57

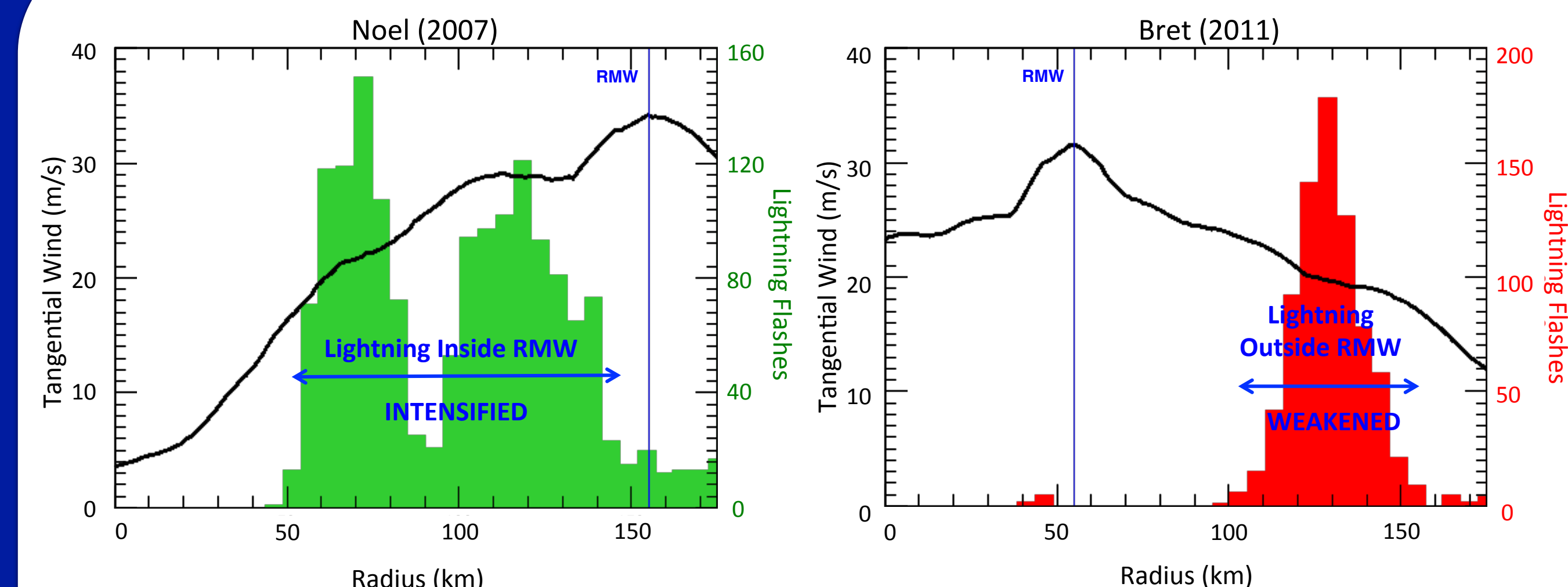
GRIP: Hurricane Earl (2010) Case Study



- Inner core lightning burst occurred **prior** to a prolonged period of **rapid intensification**

- The lightning burst was **inside the RMW** upshear but **downtilt**, likely contributing to rapid intensification

Inner Core Lightning Bursts



- Studied inner core (< 175 km) lightning bursts in the North Atlantic and East Pacific
- Analyzed factors associated with whether intensification or weakening follows burst:

Prior intensity

- Slowly intensifying TCs were more likely to *intensify*
- All other categories were more likely to *weaken*

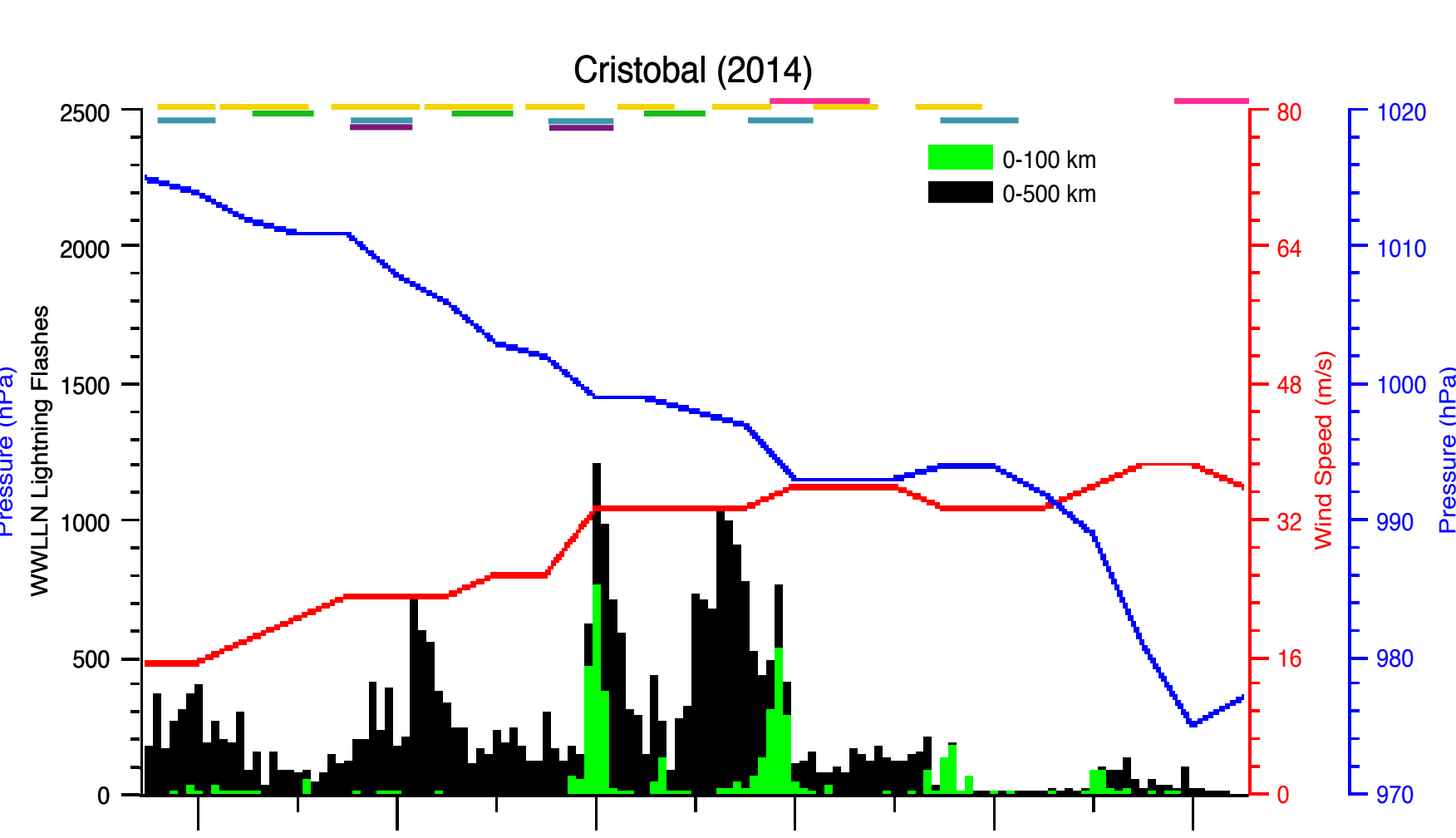
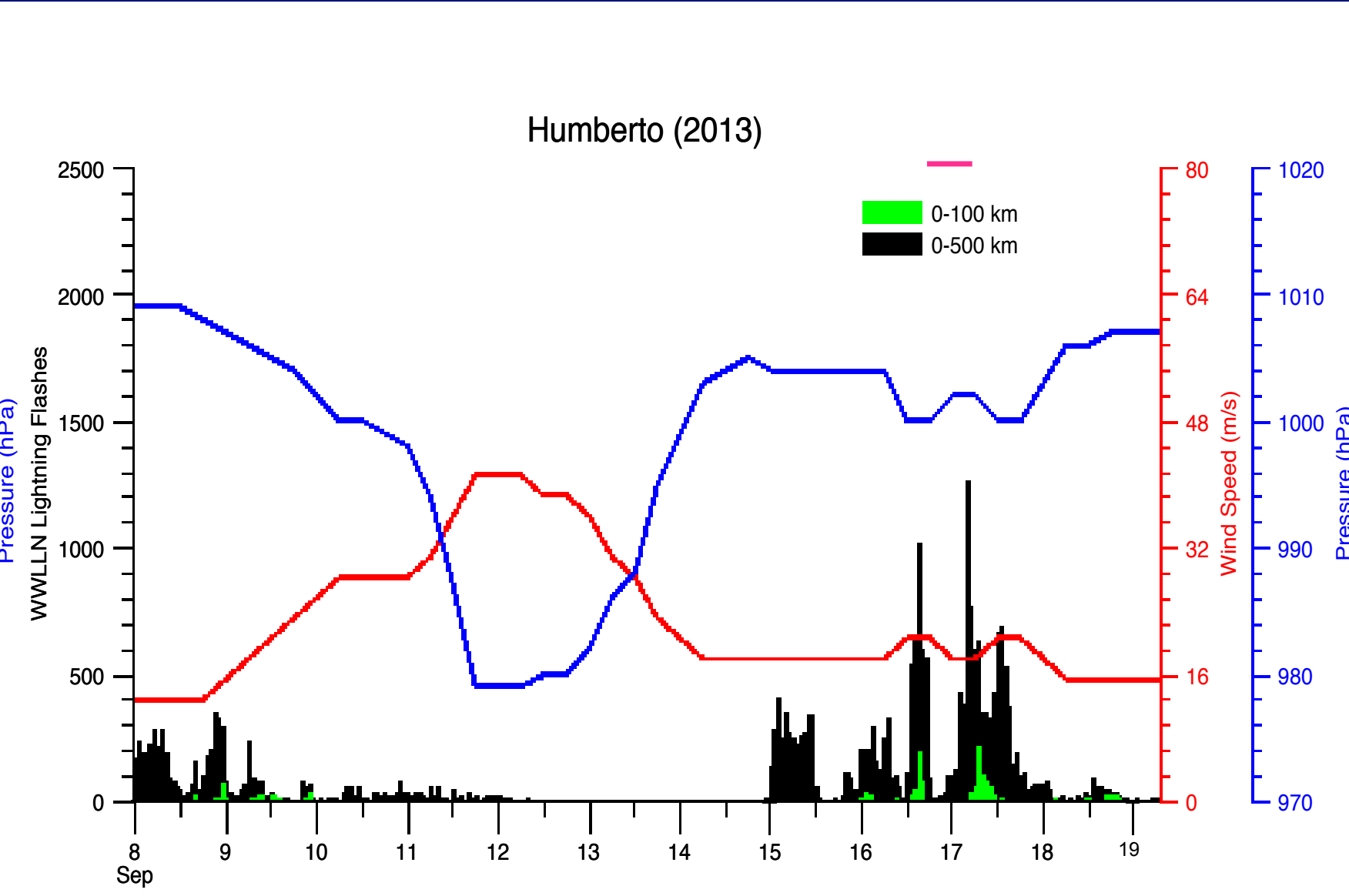
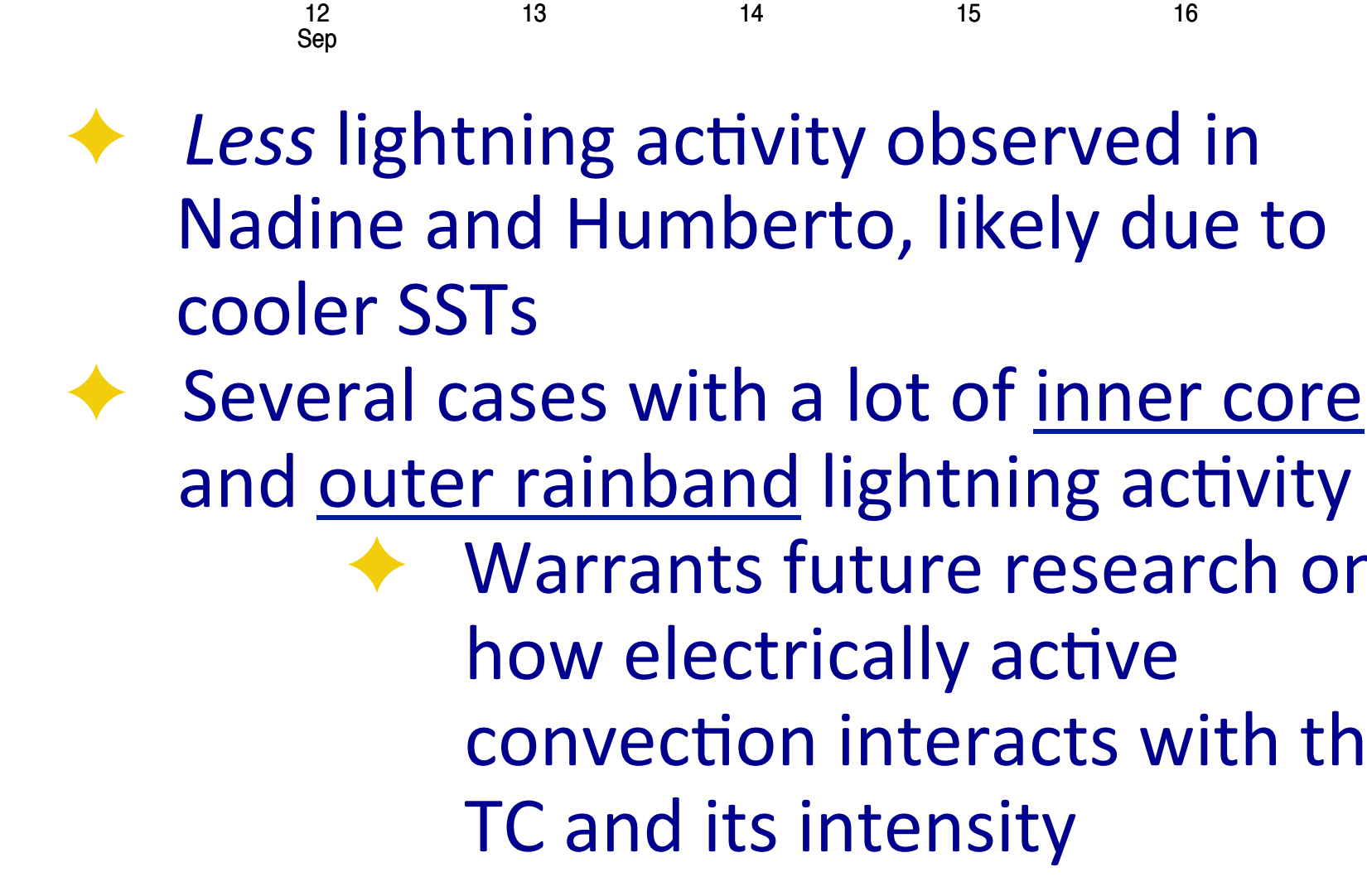
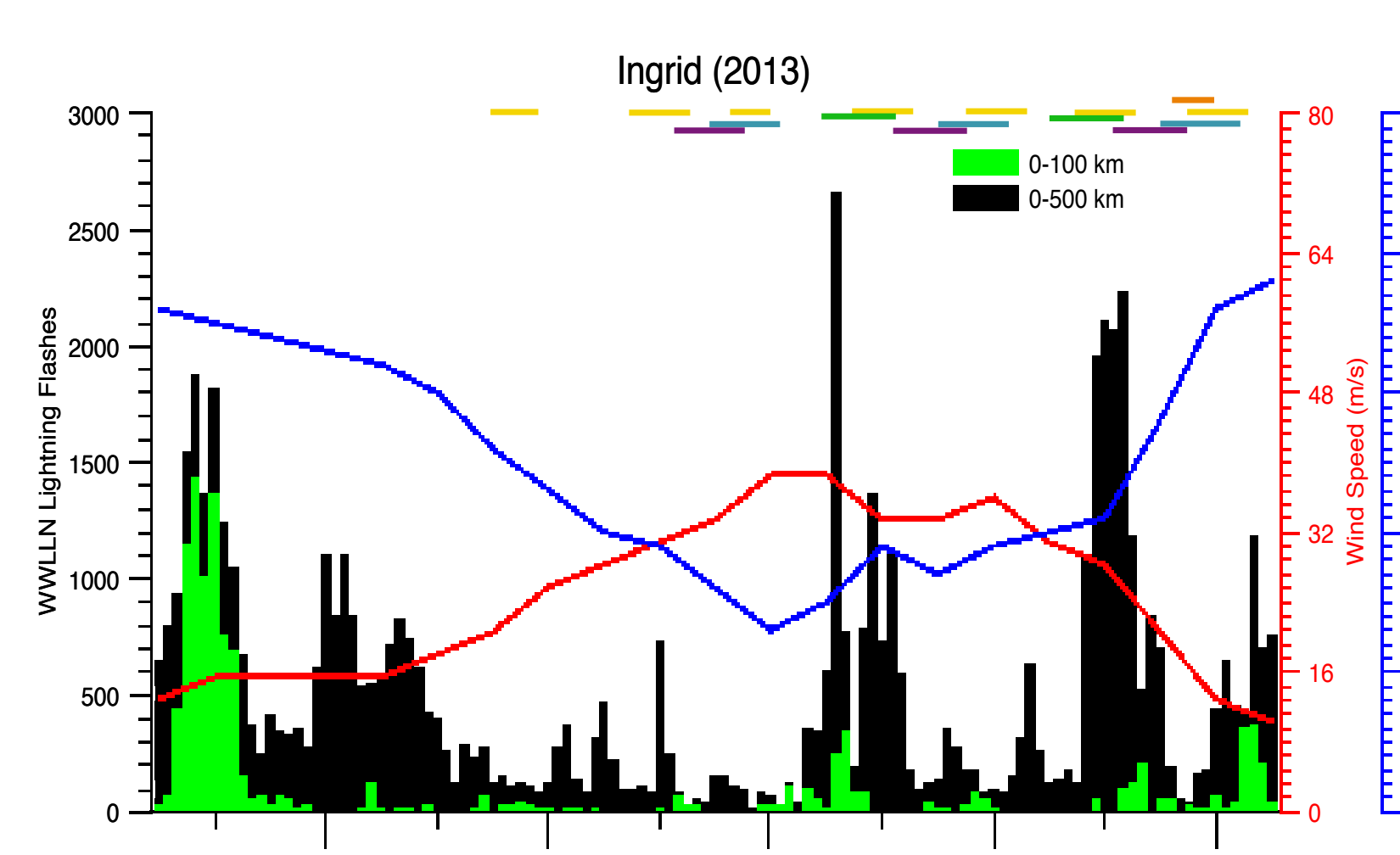
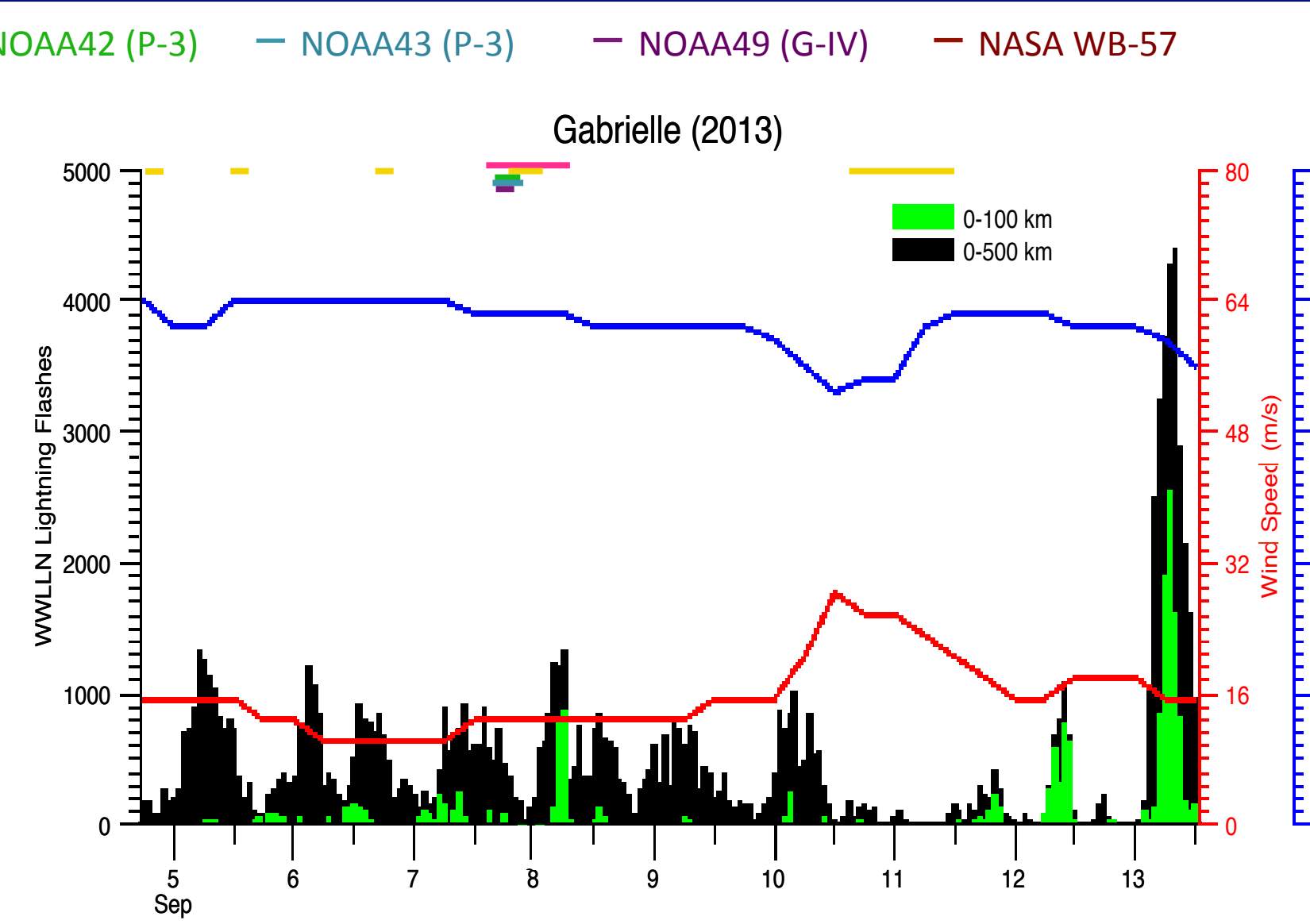
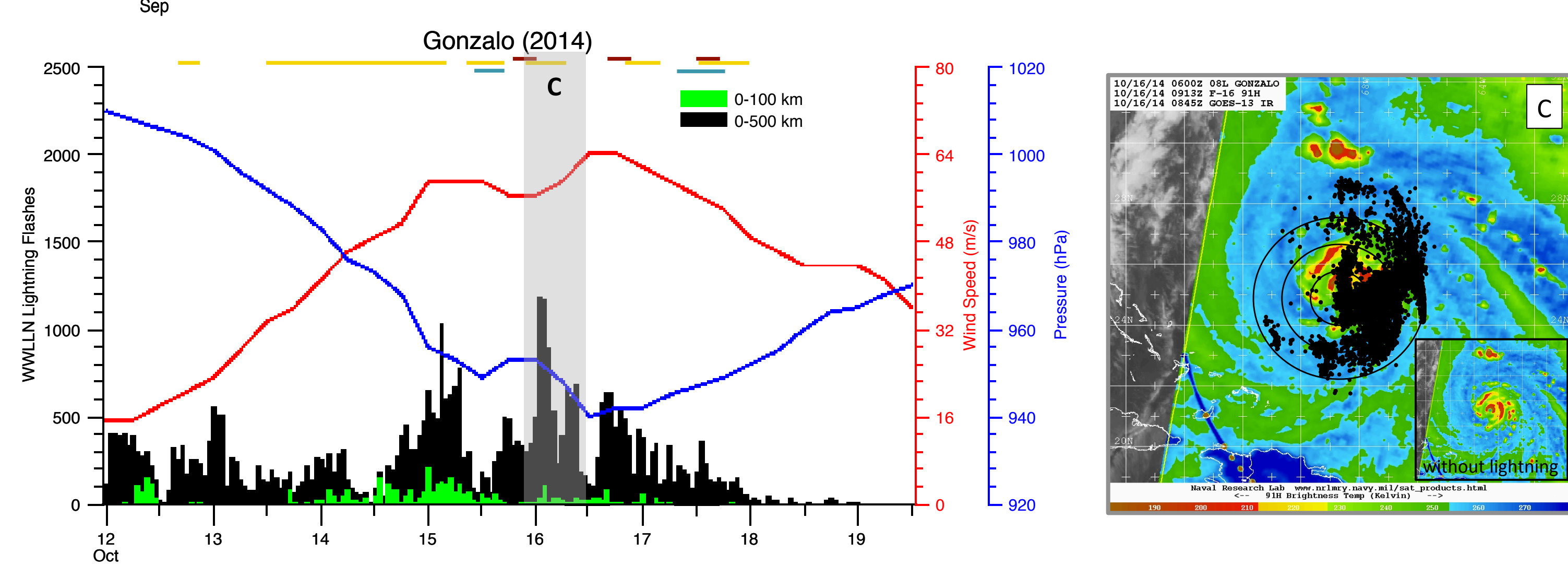
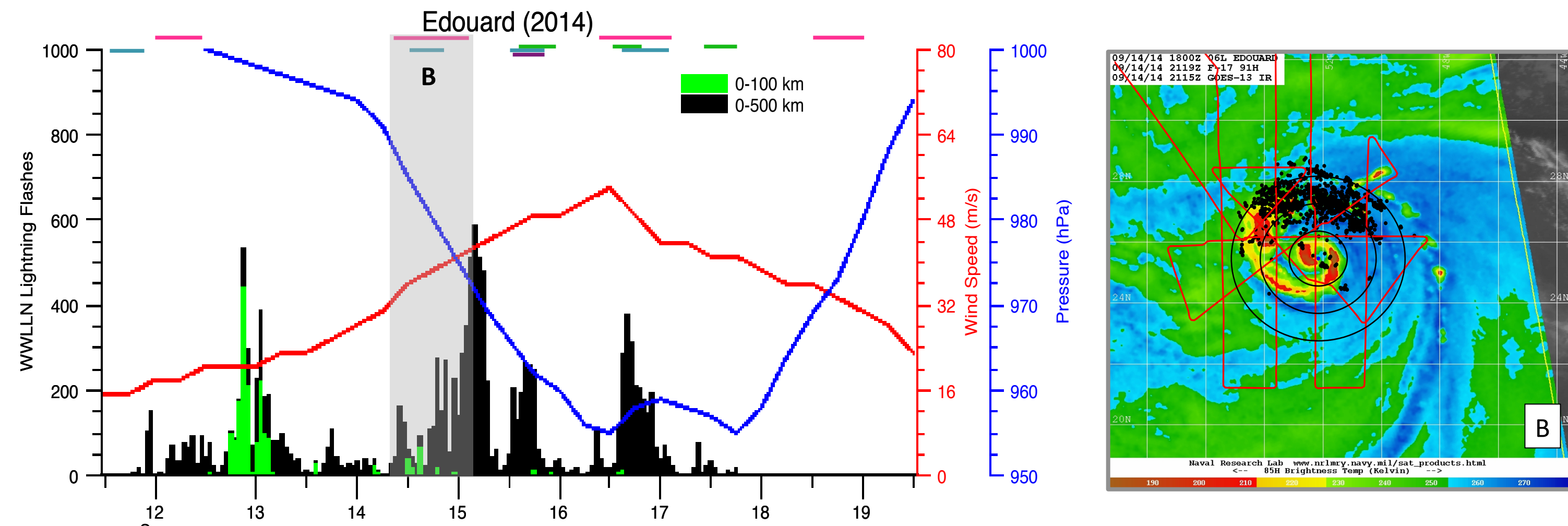
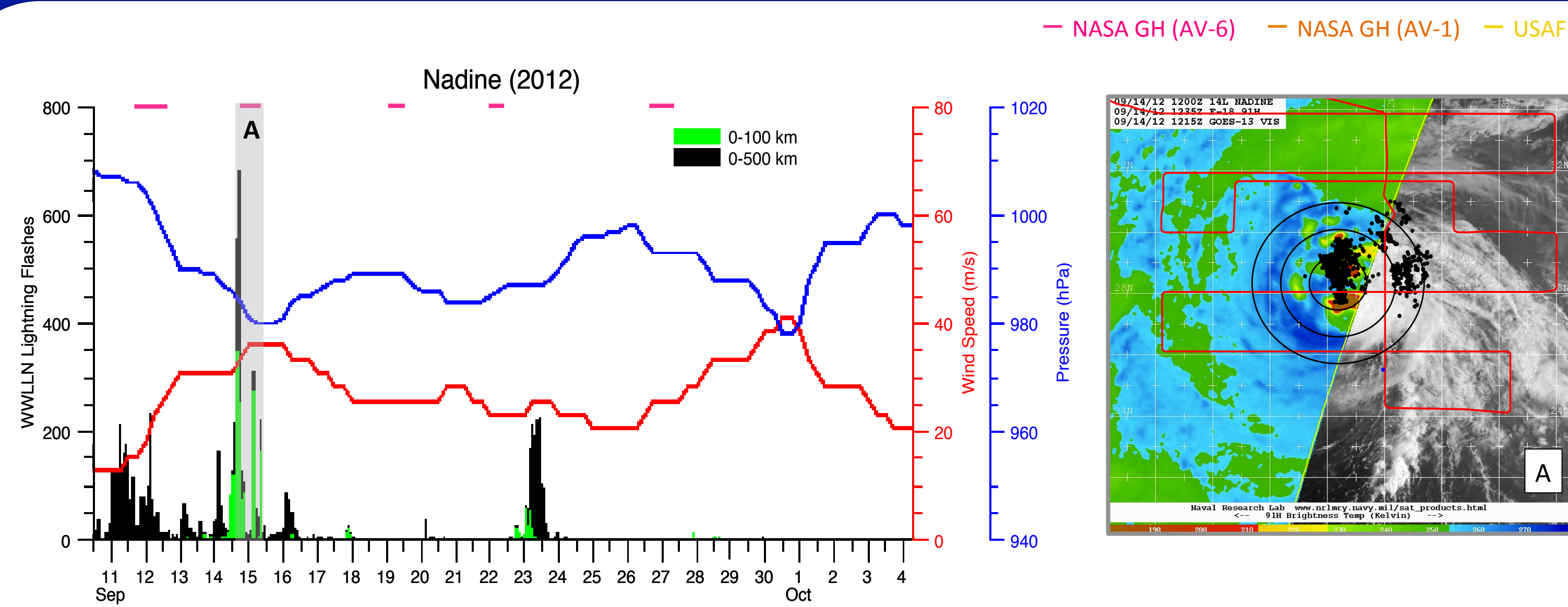
Deep-layer vertical wind shear

- No clear relationship

Radius of maximum wind (RMW)

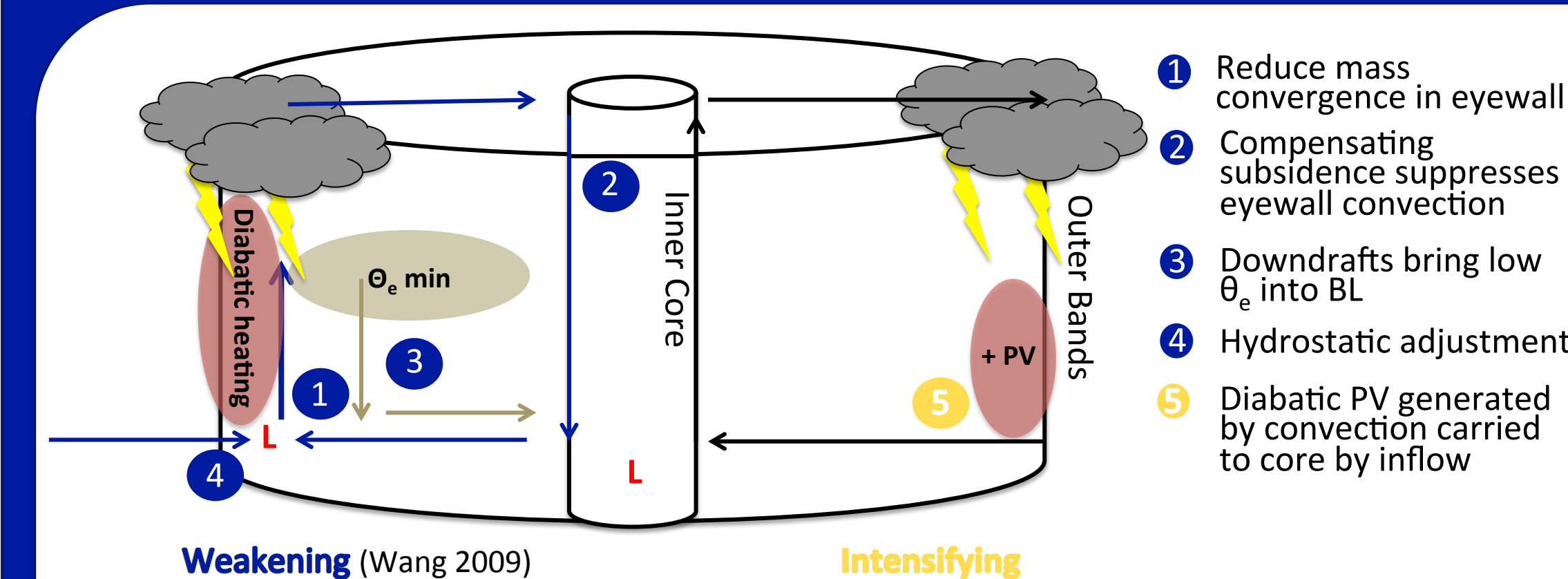
- Strong relationship – likely due to inertially stable core
- Five TCs that *weakened* had lightning burst outside RMW
- Five TCs that *intensified* had lightning burst inside RMW

HS3: Lightning observed during sampled TCs



- Less lightning activity observed in Nadine and Humberto, likely due to cooler SSTs
- Several cases with a lot of inner core and outer rainband lightning activity
 - Warrants future research on how electrically active convection interacts with the TC and its intensity

Future Work: Hypotheses for Outer Rainband Convection



- DeMaria et al. (2012) shows higher lightning flash densities (i.e., deep convection) occur in the outer rainbands of *intensifying* TCs
- Most hypothesized impacts would cause *weakening* (1 through 4)
- Research Question:** How does outer rainband convection communicate with the TC and affect its intensity?

References

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